

What is claimed is;

1. An image processing method for obtaining a processed
image signal from an original image signal representing an
original image having a certain picture element density, in which
a plurality of intermediate image signals which are different
in frequency band are made on the basis of the original image
signal, a plurality of transformed image signals are obtained
by carrying out a transformation processing on the respective
intermediate image signals on the basis of respective
transformation functions, and a processed image signal is
obtained from the transformed image signals, wherein the
improvement comprises the step of

defining said transformation functions by determining
transformation function defining parameters for the
transformation functions on the basis of the picture element
density of the original image.

2. An image processing method as defined in Claim 1 in
which said plurality of intermediate image signals are
band-limited signals which are made by carrying out on the
original image signal a filtering processing by use of filters
whose coefficients of filter are determined on the basis of the
picture element density of the original image signal, thereby
making a plurality of unsharp image signals which are different
in frequency response characteristic, and making a plurality
of band-limited signals representing the signals in the

respective frequency bands of the original image signal on the basis of the unsharp image signals and the original image signal.

3. An image processing method as defined in Claim 1 in which said predetermined transformation functions are non-linear functions.

4. An image processing method as defined in Claim 1 in which said transformation processing is a frequency enhancement processing.

5. An image processing method as defined in Claim 1 in which said transformation processing is a dynamic range compression processing.

6. An image processing method as defined in Claim 1 further comprising the step of storing the transformation function defining parameters determined for the original image signal with the parameters related to the original image signal.

7. An image processing method as defined in Claim 1 in which said step of defining said transformation functions by determining transformation function defining parameters for the transformation functions on the basis of the picture element density of the original image comprises the steps of preparing transformation function defining parameters for at least two reference picture element densities, comparing the picture element density of the original image with the reference picture element densities, and determining the transformation function defining parameters for one of the reference picture element densities closest to the picture element density of the original

image as the transformation function defining parameters for the original image signal.

8. An image processing system for obtaining a processed image signal from an original image signal representing an original image having a certain picture element density comprising an intermediate image signal making means which makes a plurality of intermediate image signals which are different in frequency band on the basis of the original image signal, and a transformation means which obtains a plurality of transformed image signals by carrying out a transformation processing on the respective intermediate image signals on the basis of respective transformation functions, and obtains a processed image signal from the transformed image signals, wherein the improvement comprises that

a transformation function defining means which determines transformation function defining parameters for the transformation functions on the basis of the picture element density of the original image and defines the transformation functions.

9. An image processing system as defined in Claim 8 in which the intermediate image signal making means comprises an unsharp image signal making means which makes a plurality of unsharp image signals which are different in frequency response characteristic by carrying out on the original image signal a filtering processing by use of filters whose coefficients of filter are determined on the basis of the picture element density

of the original image, and a band-limited signal making means which makes, as the intermediates image signals, a plurality of band-limited signals representing the signals in the respective frequency bands of the original image signal on the basis of the unsharp image signals and the original image signal.

10. An image processing system as defined in Claim 8 in which said predetermined transformation functions are non-linear functions.

11. An image processing system as defined in Claim 8 in which said transformation processing is a frequency enhancement processing.

12. An image processing system as defined in Claim 8 in which said transformation processing is a dynamic range compression processing.

13. An image processing system as defined in Claim 8 further comprising a means for storing the transformation function defining parameters determined for the original image signal with the parameters related to the original image signal.

14. An image processing system as defined in Claim 8 in which said transformation function determining means stores therein transformation function defining parameters for at least two reference picture element densities, compares the picture element density of the original image represented by the original image signal with the reference picture element densities, and determines the transformation function defining parameters for one of the reference picture element densities

closest to the picture element density of the original image as the transformation function defining parameters for the original image signal.

5 15. A computer-readable recording medium loaded with program for causing a computer to perform an image processing method for obtaining a processed image signal from an original image signal representing an original image having a certain picture element density in which a plurality of intermediate image signals which are different in frequency band are made on the basis of the original image, a plurality of transformed image signals are obtained by carrying out a transformation processing on the respective intermediate image signals on the basis of respective transformation functions, and a processed image signal is obtained from the transformed image signals, wherein the improvement comprises that

the program includes the step of defining said transformation functions by determining transformation function defining parameters for the transformation functions on the basis of the picture element density of the original image.

20 16. A computer-readable recording medium as defined in Claim 15 in which the step of making said plurality of intermediate image signals comprises the steps of carrying out on the original image signal a filtering processing by use of filters whose coefficients of filter are determined on the basis of the picture element density of the original image, thereby
25 making a plurality of unsharp image signals which are different

in frequency response characteristic, and making a plurality of band-limited signals representing the signals in the respective frequency bands of the original image signal, as said intermediate image signals, on the basis of the unsharp image signals and the original image signal.

17. A computer-readable recording medium as defined in Claim 15 in which said predetermined transformation functions are non-linear functions.

18. A computer-readable recording medium as defined in Claim 15 in which said transformation processing is a frequency enhancement processing.

19. A computer-readable recording medium as defined in Claim 15 in which said transformation processing is a dynamic range compression processing.

20. A computer-readable recording medium as defined in Claim 15 in which the program further includes the step of storing the transformation function defining parameters determined for the original image signal with the parameters related to the original image signal.

21. A computer-readable recording medium as defined in Claim 15 in which said step of defining said transformation functions by determining transformation function defining parameters for the transformation functions on the basis of the picture element density of the original image comprises the steps of preparing transformation function defining parameters for at least two reference picture element densities, comparing the

picture element density of the original image represented by the original image signal with the reference picture element densities, and determining the transformation function defining parameters for one of the reference picture element densities closest to the picture element density of the original image signal as the transformation function defining parameters for the original image signal.

22. An image processing method for obtaining a processed image signal from an original image signal representing an original image having a certain resolution, in which a plurality of intermediate image signals which are different in frequency band are made on the basis of the original image signal, a plurality of transformed image signals are obtained by carrying out a transformation processing on the respective intermediate image signals on the basis of respective transformation functions, and a processed image signal is obtained from the transformed image signals, wherein the improvement comprises that

the transformation functions for processing the intermediate image signals obtained from an object original image signal to be processed are determined by correcting, according to the resolution of the object original image signal, reference transformation functions for transforming the intermediate image signals obtained from a reference original image signal representing an image having a reference resolution, the reference transformation functions having been determined

and stored in advance.

23. An image processing method as defined in Claim 22 in which said plurality of intermediate image signals are band-limited signals which are made by carrying out on the original image signal a filtering processing by use of filters having predetermined coefficients of filter, thereby making a plurality of unsharp image signals which are different in frequency response characteristic, and making a plurality of band-limited signals representing the signals in the respective frequency bands of the original image signal on the basis of the unsharp image signals and the original image signal.

24. An image processing method as defined in Claim 22 in which said transformation functions are non-linear functions.

25. An image processing method as defined in Claim 22 in which said transformation processing is a frequency enhancement processing.

26. An image processing method as defined in Claim 22 in which said transformation processing is a dynamic range compression processing.

27. An image processing method as defined in Claim 22 in which the determined transformation functions are stored with the functions related to the original image signal.

28. An image processing method as defined in Claim 22 in which the transformation functions for band-limited signals for the original image signal to be processed are calculated so that the frequency response characteristic of the processed image

signal S_{proc} conforms to that of the reference processed image signal S_{proc0} at least in frequency bands not lower than $1/5$ of the Nyquist frequency of the original image signal to be processed.

5 29. An image processing method as defined in Claim 28 in which the transformation functions for band-limited signals for the original image signal to be processed are calculated so that the frequency response characteristic of the processed image signal S_{proc} conforms to that of the reference processed image signal S_{proc0} at least in frequency bands not lower than $1/2$ of the Nyquist frequency of the original image signal to be processed.

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20 30. An image processing system comprising an intermediate image signal making means which makes a plurality of intermediate image signals which are different in frequency band on the basis of an original image signal representing an original image having a predetermined resolution, and a transformation means which obtains a plurality of transformed image signals by carrying out a transformation processing on the respective intermediate image signals on the basis of respective transformation functions, and obtains a processed image signal from the transformed image signals, wherein the improvement comprises that

25 a transformation function calculating means which calculates the transformation functions for processing the intermediate image signals obtained from an object original

image signal to be processed by correcting, according to the resolution of the object original image signal, reference transformation functions for transforming the intermediate image signals obtained from a reference original image signal having a reference resolution, the reference transformation functions having been determined and stored in advance.

31. An image processing system as defined in Claim 30 in which the intermediate image signal making means comprises an unsharp image signal making means which makes a plurality of unsharp image signals which are different in frequency response characteristic by carrying out on the original image signal a filtering processing by use of filters whose coefficients of filter are determined on the basis of the resolution of the original image signal, and a band-limited signal making means which makes, as the intermediates image signals, a plurality of band-limited signals representing the signals in the respective frequency bands of the original image signal on the basis of the unsharp image signals and the original image signal.

32. An image processing system as defined in Claim 30 in which said predetermined transformation functions are non-linear functions.

33. An image processing system as defined in Claim 30 in which said transformation processing is a frequency enhancement processing.

34. An image processing system as defined in Claim 30 in which said transformation processing is a dynamic range

compression processing.

35. An image processing system as defined in Claim 30 further comprising a means for storing the determined transformation functions with the functions related to the original image signal.

36. An image processing system as defined in Claim 30 in which the transformation function calculating means calculates the transformation functions for processing the intermediate image signals obtained from an object original image signal to be processed by correcting, according to the resolution of the object original image signal, reference transformation functions so that the frequency response characteristic of the processed image signal conforms to that of the reference processed image signal at least in frequency bands not lower than $1/5$ of the Nyquist frequency of the original image signal to be processed.

37. An image processing system as defined in Claim 36 in which the transformation function calculating means calculates the transformation functions for processing the intermediate image signals obtained from an object original image signal to be processed by correcting, according to the resolution of the object original image signal, reference transformation functions so that the frequency response characteristic of the processed image signal conforms to that of the reference processed image signal at least in frequency bands not lower than $1/2$ of the Nyquist frequency of the original image signal

to be processed.

38. A computer-readable recording medium loaded with program for causing a computer to perform an image processing method in which a plurality of intermediate image signals which are different in frequency band are made on the basis of an original image signal representing an original image having a predetermined resolution, a plurality of transformed image signals are obtained by carrying out a transformation processing on the respective intermediate image signals on the basis of respective transformation functions, and a processed image signal is obtained from the transformed image signals, wherein the improvement comprises that

the program includes the step of calculating the transformation functions for processing the intermediate image signals obtained from an object original image signal to be processed by correcting, according to the resolution of the object original image signal, reference transformation functions for transforming the intermediate image signals obtained from a reference original image signal having a reference resolution, the reference transformation functions having been determined and stored in advance.

39. A computer-readable recording medium as defined in Claim 38 in which the step of making said plurality of intermediate image signals comprises the steps of carrying out on the original image signal a filtering processing by use of filters whose coefficients of filter are determined on the basis

of the resolution of the original image signal, thereby making a plurality of unsharp image signals which are different in frequency response characteristic, and making a plurality of band-limited signals representing the signals in the respective frequency bands of the original image signal, as said intermediate image signals, on the basis of the unsharp image signals and the original image signal.

40. A computer-readable recording medium as defined in Claim 38 in which said predetermined transformation functions are non-linear functions.

41. A computer-readable recording medium as defined in Claim 38 in which said transformation processing is a frequency enhancement processing.

42. A computer-readable recording medium as defined in Claim 38 in which said transformation processing is a dynamic range compression processing.

43. A computer-readable recording medium as defined in Claim 38 in which said program further comprises the step of storing the determined transformation functions with the functions related to the original image signal.

44. A computer-readable recording medium as defined in Claim 38 in which the reference transformation functions are corrected according to the resolution of the object original image signal so that the frequency response characteristic of the processed image signal conforms to that of the reference processed image signal at least in frequency bands not lower

than 1/5 of the Nyquist frequency of the original image signal to be processed.

45. A computer-readable recording medium as defined in Claim 44 in which the reference transformation functions are corrected according to the resolution of the object original image signal so that the frequency response characteristic of the processed image signal S_{proc} conforms to that of the reference processed image signal S_{proc0} at least in frequency bands not lower than 1/2 of the Nyquist frequency of the original image signal to be processed.

46. An image processing method for obtaining a processed image signal from an original image signal representing an original image having a certain resolution, in which a plurality of intermediate image signals which are different in frequency band are made on the basis of the original image signal, a plurality of transformed image signals are obtained by carrying out a transformation processing on the respective intermediate image signals on the basis of transformation functions which are set according to the frequency bands of the respective intermediate image signals, and a processed image signal is obtained from the transformed image signals, wherein the improvement comprises the steps of

preparing reference transformation functions for transforming the intermediate image signals obtained from a reference original image signal representing a reference original image having a reference resolution which are set

according to the frequency bands of the respective intermediate image signals, and, when an object original image signal to be processed represents an original image having a resolution lower than the reference resolution, setting the transformation functions for transforming the intermediate image signals obtained from the object original image signal to be equal to the respective reference transformation functions for the intermediate image signals in the frequency bands not higher than the frequency band corresponding to the resolution of the original image represented by the object original image signal.

47. An image processing method as defined in Claim 46 in which said plurality of intermediate image signals are band-limited signals which are made by making, on the basis of the original image signal, a plurality of unsharp image signals which are different in frequency response characteristic, and making a plurality of band-limited signals representing the signals in the respective frequency bands of the original image signal on the basis of the unsharp image signals and the original image signal.

48. An image processing method as defined in Claim 46 in which information on the resolution of the object original image signal is obtained and the step of setting the transformation functions for transforming the intermediate image signals obtained from the object original image signal is executed on the basis of the information.

49. An image processing system for obtaining a processed

image signal from an original image signal representing an original image having a certain resolution comprising an intermediate signal making means which makes a plurality of intermediate image signals which are different in frequency band on the basis of the original image signal, and a transformation processing means which makes a plurality of transformed image signals by carrying out a transformation processing on the respective intermediate image signals on the basis of transformation functions which are set according to the frequency bands of the respective intermediate image signals and obtains a processed image signal from the transformed image signals, wherein the improvement comprises that

the transformation processing means prepares reference transformation functions for transforming the intermediate image signals obtained from a reference original image signal representing a reference original image having a reference resolution which are set according to the frequency bands of the respective intermediate image signals, and, when the object original image signal to be processed represents an original image having a resolution lower than the reference resolution, sets the transformation functions for transforming the intermediate image signals obtained from the object original image signal to be equal to the respective reference transformation functions for the intermediate image signals in the frequency bands not higher than the frequency band corresponding to the resolution of the original image

represented by the object original image signal.

50. An image processing system as defined in Claim 49 in which the intermediate image signal making means comprises an unsharp image signal making means which makes a plurality of unsharp image signals which are different in frequency response characteristic on the basis of the original image, and a band-limited signal making means which makes, as the intermediates image signals, a plurality of band-limited signals representing the signals in the respective frequency bands of the original image signal on the basis of the unsharp image signals and the original image signal.

51. An image processing system as defined in Claim 49 in which a resolution information obtaining means for obtaining information on the resolution of the original image represented by the object original image signal is provided and the transformation processing means sets the transformation functions for transforming the intermediate image signals obtained from the object original image signal on the basis of the information.

52. A computer-readable recording medium loaded with program for causing a computer to perform an image processing method for obtaining a processed image signal from an original image signal representing an original image having a certain resolution, in which a plurality of intermediate image signals which are different in frequency band are made on the basis of the original image signal, a plurality of transformed image

signals are obtained by carrying out a transformation processing on the respective intermediate image signals on the basis of transformation functions which are set according to the frequency bands of the respective intermediate image signals, and a processed image signal is obtained from the transformed image signals, wherein the improvement comprises that

the program includes the steps of preparing reference transformation functions for transforming the intermediate image signals obtained from a reference original image signal representing a reference original image having a reference resolution which are set according to the frequency bands of the respective intermediate image signals, and, when the object original image signal to be processed represents an original image having a resolution lower than the reference resolution, setting the transformation functions for transforming the intermediate image signals obtained from the object original image signal to be equal to the respective reference transformation functions for the intermediate image signals in the frequency bands not higher than the frequency band corresponding to the resolution of the original image represented by the object original image signal.

53. A computer-readable recording medium as defined in Claim 52 in which said plurality of intermediate image signals are band-limited signals which are made by making, on the basis of the original image signal, a plurality of unsharp image signals which are different in frequency response

characteristic, and making a plurality of band-limited signals representing the signals in the respective frequency bands of the original image signal on the basis of the unsharp image signals and the original image signal.

5 54. A computer-readable recording medium as defined in Claim 52 in which information on the resolution of the object original image signal is obtained and the step of setting the transformation functions for transforming the intermediate image signals obtained from the object original image signal is executed on the basis of the information.

10 55. An image processing method for making a contraction-processed image signal representing an image having a desired resolution lower than that of an image represented by a reference processed image signal which is obtained by making
15 first to n-th reference low resolution image signals from a reference original image signal representing a reference original image, the reference low resolution image signals being different from each other in frequency band and respectively representing images whose resolutions are $1/2^k$ ($k=1$ to n) of the
20 resolution of the reference original image signal; making reference low-resolution band-limited signals on the basis of the reference low resolution image signals; obtaining a plurality of reference transformed image signals by carrying out a predetermined transformation processing on the reference
25 low resolution band-limited signals on the basis of a plurality of reference transformation functions which are set according

to the respective frequency bands of the reference low resolution band-limited signals; and carrying out a predetermined processing on the reference transformed image signals, the image processing method characterized by the steps of

5 taking as an original image signal one of said first to n-th reference low resolution image signals representing an image whose resolution is the closest to said desired resolution in the images represented by the reference low resolution image signals; making first to m-th low resolution image signals from the original image signal, the low resolution image signals being
10 different from each other in frequency band and respectively representing images whose resolutions are $1/2^{k'}$ ($k'=1$ to m) of the resolution of the original image signal; making a low-resolution band-limited signals on the basis of the low
15 resolution image signals; obtaining a plurality of transformed image signals by carrying out said predetermined transformation processing on the low resolution band-limited signals on the basis of a part of said reference transformation functions which are set for the respective frequency bands of the reference low
20 resolution band-limited signals not higher than the frequency band corresponding to the resolution closest to said desired resolution; carrying out said predetermined processing on the transformed image signals, thereby obtaining an intermediate processed image signal; enlarging or contracting the
25 intermediate processed image so that the resolution of the image represented by the intermediate processed image signal becomes

equal to the desired resolution; and taking the enlarged or contracted intermediate processed image signal as the contraction-processed image signal.

56. An image processing method as defined in Claim 55 in which said low resolution band-limited signals are made by making, on the basis of the original image signal, a plurality of unsharp image signals which are different in frequency response characteristic, and making a plurality of band-limited signals representing the signals in the respective frequency bands of the original image signal on the basis of the unsharp image signals and the original image signal.

57. An image processing system for making a contraction-processed image signal representing an image having a desired resolution lower than that of an image represented by a reference processed image signal which is obtained by making first to n-th reference low resolution image signals from a reference original image signal representing a reference original image, the reference low resolution image signals being different from each other in frequency band and respectively representing images whose resolutions are $1/2^k$ ($k=1$ to n) of the resolution of the original image represented by the reference original image signal; making reference low-resolution band-limited signals on the basis of the reference low resolution image signals; obtaining a plurality of reference transformed image signals by carrying out a predetermined transformation processing on the reference low resolution band-limited signals

on the basis of a plurality of reference transformation functions which are set according to the respective frequency bands of the reference low resolution band-limited signals; and carrying out a predetermined processing on the reference transformed image signals, the image processing system characterized by having

a selection means which selects, as an original image signal, one of said first to n-th reference low resolution image signals representing an image whose resolution is the closest to said desired resolution in the images represented by the reference low resolution image signals; a low resolution image signal making means which makes first to m-th low resolution image signals from the original image signal, the low resolution image signals being different from each other in frequency band and respectively representing images whose resolutions are $1/2^{k'}$ ($k'=1$ to m) of the resolution of the original image signal; a low resolution band-limited signal making means which makes a low resolution band-limited signals on the basis of the low resolution image signals; a transformation processing means which obtains a plurality of transformed image signals by carrying out said predetermined transformation processing on the low resolution band-limited signals on the basis of a part of said reference transformation functions which are set for the respective frequency bands of the reference low resolution image signals not higher than the frequency band corresponding to the resolution closest to said desired resolution and carries

out said predetermined processing on the transformed image signals, thereby obtaining an intermediate processed image signal; and an enlarging/contracting means which enlarges or contracts the intermediate processed image so that the resolution of the image represented by the intermediate processed image signal becomes equal to the desired resolution.

58. An image processing system as defined in Claim 57 in which said low resolution band-limited signal making means makes on the basis of the original image signal, a plurality of unsharp image signals which are different in frequency response characteristic, and makes a plurality of band-limited signals representing the signals in the respective frequency bands of the original image signal on the basis of the unsharp image signals and the original image signal.

59. A computer-readable recording medium loaded with program for causing a computer to perform an image processing method for making a contraction-processed image signal representing an image having a desired resolution lower than that of an image represented by a reference processed image signal which is obtained by making first to n-th reference low resolution image signals from a reference original image signal representing a reference original image, the reference low resolution image signals being different from each other in frequency band and respectively representing images whose resolutions are $1/2^k$ ($k=1$ to n) of the resolution of the reference original image signal; making reference low-resolution

band-limited signals on the basis of the reference low resolution image signals; obtaining a plurality of reference transformed image signals by carrying out a predetermined transformation processing on the reference low resolution band-limited signals on the basis of a plurality of reference transformation functions which are set according to the respective frequency bands of the reference low resolution band-limited signals; and carrying out a predetermined processing on the reference transformed image signals, the improvement comprises that

the program includes the steps of taking as an original image signal one of said first to n-th reference low resolution image signals representing an image whose resolution is the closest to said desired resolution in the images represented by the reference low resolution image signals; making first to m-th low resolution image signals from the original image signal, the low resolution image signals being different from each other in frequency band and respectively representing images whose resolutions are $1/2^{k'}$ ($k'=1$ to m) of the resolution of the original image signal; making a low-resolution band-limited signals on the basis of the low resolution image signals; obtaining a plurality of transformed image signals by carrying out said predetermined transformation processing on the low resolution band-limited signals on the basis of a part of said reference transformation functions which are set for the respective frequency bands of the reference low resolution band-limited signals not higher than the frequency band corresponding to the

resolution closest to said desired resolution; carrying out said predetermined processing on the transformed image signals, thereby obtaining an intermediate processed image signal; enlarging or contracting the intermediate processed image so
5 that the resolution of the image represented by the intermediate processed image signal becomes equal to the desired resolution; and taking the enlarged or contracted intermediate processed image signal as the contraction-processed image signal.

60. A computer-readable recording medium as defined in Claim 59 in which said low resolution band-limited signals are made by making, on the basis of the original image signal, a plurality of unsharp image signals which are different in frequency response characteristic, and making a plurality of band-limited signals representing the signals in the respective frequency bands of the original image signal on the basis of the unsharp image signals and the original image signal.
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61. An image processing method for obtaining a processed image signal from an original image signal representing an original image having a certain resolution, in which a plurality of intermediate image signals which are different in frequency band are made on the basis of the original image signal, a plurality of transformed image signals are obtained by carrying out a transformation processing on the respective intermediate image signals on the basis of transformation functions which
20 are set according to the frequency bands of the respective intermediate image signals, and a processed image signal is
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obtained from the transformed image signals, wherein the improvement comprises the steps of

preparing reference transformation functions for transforming the intermediate image signals obtained from a reference original image signal representing a reference original image having a reference resolution which are set according to the frequency bands of the respective intermediate image signals, and, when an object original image signal to be processed represents an original image having a resolution higher than the reference resolution, setting the transformation functions for transforming the intermediate image signals obtained from the object original image signal in frequency bands not higher than the frequency band corresponding to the reference resolution to be equal to the respective reference transformation functions and the transformation functions for transforming the intermediate image signals obtained from the object original image signal in frequency bands higher than the frequency band corresponding to the reference resolution to be equal to the reference transformation function for transforming the intermediate image signal obtained from the reference original image signal in the highest frequency band.

62. An image processing method as defined in Claim 61 in which said plurality of intermediate image signals are band-limited signals which are made by making, on the basis of the original image signal, a plurality of unsharp image signals

which are different in frequency response characteristic, and making a plurality of band-limited signals representing the signals in the respective frequency bands of the original image signal on the basis of the unsharp image signals and the original image signal.

63. An image processing method as defined in Claim 61 in which information on the resolution of the object original image signal is obtained and the step of setting the transformation functions for transforming the intermediate image signals obtained from the object original image signal is executed on the basis of the information.

64. An image processing method as defined in Claim 61 further comprising the step of storing the transformation function defining parameters determined for the original image signal with the parameters related to the original image signal.

65. An image processing system for obtaining a processed image signal from an original image signal representing an original image having a certain resolution comprising an intermediate signal making means which makes a plurality of intermediate image signals which are different in frequency band on the basis of the original image signal, and a transformation processing means which makes a plurality of transformed image signals by carrying out a transformation processing on the respective intermediate image signals on the basis of transformation functions which are set according to the frequency bands of the respective intermediate image signals

and obtains a processed image signal from the transformed image signals, wherein the improvement comprises that

the transformation processing means prepares reference transformation functions for transforming the intermediate image signals obtained from a reference original image signal representing a reference original image having a reference resolution which are set according to the frequency bands of the respective intermediate image signals, and, when an object original image signal to be processed represents an original image having a resolution higher than the reference resolution, sets the transformation functions for transforming the intermediate image signals obtained from the object original image signal in frequency bands not higher than the frequency band corresponding to the reference resolution to be equal to the respective reference transformation functions and the transformation functions for transforming the intermediate image signals obtained from the object original image signal in frequency bands higher than the frequency band corresponding to the reference resolution to be equal to the reference transformation function for transforming the intermediate image signal obtained from the reference original image signal in the highest frequency band.

66. An image processing system as defined in Claim 65 in which the intermediate image signal making means comprises an unsharp image signal making means which makes a plurality of unsharp image signals which are different in frequency response

characteristic on the basis of the original image, and a band-limited signal making means which makes, as the intermediates image signals, a plurality of band-limited signals representing the signals in the respective frequency bands of the original image signal on the basis of the unsharp image signals and the original image signal.

67. An image processing system as defined in Claim 65 in which a resolution information obtaining means for obtaining information on the resolution of the original image represented by the object original image signal is provided and the transformation processing means sets the transformation functions for transforming the intermediate image signals obtained from the object original image signal on the basis of the information.

68. An image processing system as defined in Claim 65 further comprising a means for storing the transformation function defining parameters determined for the original image signal with the parameters related to the original image signal.

69. A computer-readable recording medium loaded with program for causing a computer to perform an image processing method for obtaining a processed image signal from an original image signal representing an original image having a certain resolution, in which a plurality of intermediate image signals which are different in frequency band are made on the basis of the original image signal, a plurality of transformed image signals are obtained by carrying out a transformation processing

on the respective intermediate image signals on the basis of transformation functions which are set according to the frequency bands of the respective intermediate image signals, and a processed image signal is obtained from the transformed image signals, wherein the improvement comprises that

the program includes the steps of preparing reference transformation functions for transforming the intermediate image signals obtained from a reference original image signal representing a reference original image having a reference resolution which are set according to the frequency bands of the respective intermediate image signals, and, when an object original image signal to be processed represents an original image having a resolution higher than the reference resolution, setting the transformation functions for transforming the intermediate image signals obtained from the object original image signal in frequency bands not higher than the frequency band corresponding to the reference resolution to be equal to the respective reference transformation functions and the transformation functions for transforming the intermediate image signals obtained from the object original image signal in frequency bands higher than the frequency band corresponding to the reference resolution to be equal to the reference transformation function for transforming the intermediate image signal obtained from the reference original image signal in the highest frequency band.

70. A computer-readable recording medium as defined in

Claim 69 in which said plurality of intermediate image signals are band-limited signals which are made by making, on the basis of the original image signal, a plurality of unsharp image signals which are different in frequency response characteristic, and making a plurality of band-limited signals representing the signals in the respective frequency bands of the original image signal on the basis of the unsharp image signals and the original image signal.

71. A computer-readable recording medium as defined in Claim 69 in which information on the resolution of the object original image signal is obtained and the step of setting the transformation functions for transforming the intermediate image signals obtained from the object original image signal is executed on the basis of the information.

72. A computer-readable recording medium as defined in Claim 69 in which the program further includes the step of storing the transformation function defining parameters determined for the original image signal with the parameters related to the original image signal.

73. An image processing method for obtaining a processed image signal from an original image signal representing an original image having a certain picture element density, in which a plurality of intermediate image signals which are different in frequency band are made on the basis of the original image signal, a plurality of transformed image signals are obtained by carrying out a transformation processing on the respective

intermediate image signals on the basis of respective transformation functions, and a processed image signal in which a predetermined frequency component is enhanced is obtained from the transformed image signals, wherein the improvement comprises that

when an object original image signal to be processed is a contracted image signal obtained by carrying out a picture element density transformation processing on a reference original image signal representing an image having a reference picture element density, the transformation functions for processing the intermediate image signals obtained from the object original image signal are determined by correcting, according to the characteristic of the picture element density transformation processing, reference transformation functions for transforming the intermediate image signals obtained from the reference original image so that the frequency response characteristic of a desired frequency component of the processed image signal obtained from the object original image signal becomes equivalent to that of the processed image signal obtained from the reference original image signal, the reference transformation functions having been determined and stored in advance.

74. An image processing method as defined in Claim 73 in which when the processed image signal obtained from the contracted image signal is enlarged at a magnification, the transformation functions for processing the intermediate image

signals obtained from the object original image signal are determined by correcting the reference transformation functions according to both the characteristic of the picture element density transformation processing and the characteristic of the enlargement.

75. An image processing method as defined in Claim 73 in which said plurality of intermediate image signals are band-limited signals which are made by making from the original image signal a plurality of unsharp image signals which are different in frequency response characteristic, and making a plurality of band-limited signals representing the signals in the respective frequency bands of the original image signal on the basis of the unsharp image signals and the original image signal.

76. An image processing method as defined in Claim 73 in which the object original image signal and the parameters for the object original image signal obtained by correcting the reference transformation functions according to the characteristic of contraction are stored correlated to each other.

77. An image processing method as defined in Claim 73 in which the reference original image signal from which the object original image signal is obtained, the characteristic of contraction with which the reference original image signal is contracted to the object original image signal and the parameters of the reference transformation functions be stored correlated

to each other.

78. An image processing method for obtaining a processed image signal from an original image signal representing an original image, in which a plurality of intermediate image signals which are different in frequency band are made on the basis of the original image signal, a plurality of transformed image signals are obtained by carrying out a transformation processing on the respective intermediate image signals on the basis of respective transformation functions, and a processed image signal in which a predetermined frequency component is enhanced is obtained from the transformed image signals, wherein the improvement comprises that

when an enlarged processed image signal is to be obtained by enlarging the processed image signal at a desired magnification by carrying out an enlargement transformation on the processed image signal, the transformation functions for transforming the respective intermediate image signals are corrected according to the characteristic of the enlargement transformation so that the frequency response characteristic of a desired frequency component of the enlarged processed image signal becomes a predetermined frequency response characteristic.

79. An image processing method as defined in Claim 78 in which said plurality of intermediate image signals are band-limited signals which are made by making from the original image signal a plurality of unsharp image signals which are

different in frequency response characteristic, and making a plurality of band-limited signals representing the signals in the respective frequency bands of the original image signal on the basis of the unsharp image signals and the original image signal.

80. An image processing method as defined in Claim 78 in which the object original image signal and the parameters for the object original image signal obtained by correcting the reference transformation functions according to the characteristic of enlargement are stored correlated to each other.

81. An image processing method as defined in Claim 78 in which the reference original image signal from which the object original image signal is obtained, the characteristic of enlargement with which the reference original image signal is enlarged to the object original image signal and the parameters of the reference transformation functions be stored correlated to each other.

82. An image processing system for obtaining a processed image signal from an original image signal representing an original image having a certain picture element density, in which a plurality of intermediate image signals which are different in frequency band are made on the basis of the original image signal, a plurality of transformed image signals are obtained by carrying out a transformation processing on the respective intermediate image signals on the basis of respective

transformation functions, and a processed image signal in which a predetermined frequency component is enhanced is obtained from the transformed image signals, wherein the improvement comprising

5 a transformation function correcting means which, when an object original image signal to be processed is a contracted image signal obtained by carrying out a picture element density transformation processing on a reference original image signal representing an image having a reference picture element density,
10 determines the transformation functions for processing the intermediate image signals obtained from the object original image signal by correcting, according to the characteristic of the picture element density transformation processing, reference transformation functions for transforming the
15 intermediate image signals obtained from the reference original image so that the frequency response characteristic of a desired frequency component of the processed image signal obtained from the object original image signal becomes equivalent to that of the processed image signal obtained from the reference original
20 image signal, the reference transformation functions having been determined and stored in advance.

83. An image processing system as defined in Claim 82 in which, when the processed image signal obtained from the contracted image signal is enlarged at a magnification, the
25 transformation function correcting means determines the transformation functions for processing the intermediate image

signals obtained from the object original image signal by correcting the reference transformation functions according to both the characteristic of the picture element density transformation processing and the characteristic of the enlargement.

84. An image processing system as defined in Claim 82 in which said plurality of intermediate image signals are band-limited signals which are made by making from the original image signal a plurality of unsharp image signals which are different in frequency response characteristic, and making a plurality of band-limited signals representing the signals in the respective frequency bands of the original image signal on the basis of the unsharp image signals and the original image signal.

85. An image processing method as defined in Claim 82 further comprising a means for storing the object original image signal and the parameters for the object original image signal obtained by correcting the reference transformation functions according to the characteristic of contraction correlated to each other.

86. An image processing method as defined in Claim 82 further comprising a means for storing the reference original image signal from which the object original image signal is obtained, the characteristic of contraction with which the reference original image signal is contracted to the object original image signal and the parameters of the reference

transformation functions correlated to each other.

87. An image processing system for obtaining a processed image signal from an original image signal representing an original image, in which a plurality of intermediate image signals which are different in frequency band are made on the basis of the original image signal, a plurality of transformed image signals are obtained by carrying out a transformation processing on the respective intermediate image signals on the basis of respective transformation functions, and a processed image signal in which a predetermined frequency component is enhanced is obtained from the transformed image signals, wherein the improvement comprising

a transformation function correcting means which, when an enlarged processed image signal is to be obtained by enlarging the processed image signal at a desired magnification by carrying out an enlargement transformation on the processed image signal, corrects the transformation functions for transforming the respective intermediate image signals according to the characteristic of the enlargement transformation so that the frequency response characteristic of a desired frequency component of the enlarged processed image signal becomes a predetermined frequency response characteristic.

88. An image processing system as defined in Claim 87 in which said plurality of intermediate image signals are band-limited signals which are made by making from the original image signal a plurality of unsharp image signals which are

different in frequency response characteristic, and making a plurality of band-limited signals representing the signals in the respective frequency bands of the original image signal on the basis of the unsharp image signals and the original image signal.

89. An image processing method as defined in Claim 87 further comprising a means for storing the object original image signal and the parameters for the object original image signal obtained by correcting the reference transformation functions according to the characteristic of enlargement correlated to each other.

90. An image processing method as defined in Claim 87 further comprising a means for storing the reference original image signal from which the object original image signal is obtained, the characteristic of enlargement with which the reference original image signal is enlarged to the object original image signal and the parameters of the reference transformation functions correlated to each other.

91. A computer-readable recording medium loaded with program for causing a computer to perform an image processing method for obtaining a processed image signal from an original image signal representing an original image having a certain picture element density, in which a plurality of intermediate image signals which are different in frequency band are made on the basis of the original image signal, a plurality of transformed image signals are obtained by carrying out a

transformation processing on the respective intermediate image signals on the basis of respective transformation functions, and a processed image signal in which a predetermined frequency component is enhanced is obtained from the transformed image signals, wherein the improvement comprises that

the program includes the step of, when an object original image signal to be processed is a contracted image signal obtained by carrying out a picture element density transformation processing on a reference original image signal representing an image having a reference picture element density, determining the transformation functions for processing the intermediate image signals obtained from the object original image signal by correcting, according to the characteristic of the picture element density transformation processing, reference transformation functions for transforming the intermediate image signals obtained from the reference original image so that the frequency response characteristic of a desired frequency component of the processed image signal obtained from the object original image signal becomes equivalent to that of the processed image signal obtained from the reference original image signal, the reference transformation functions having been determined and stored in advance.

92. A computer-readable recording medium as defined in Claim 91 in which said program further includes the step of, when the processed image signal obtained from the contracted image signal is enlarged at a magnification, determining the

transformation functions for processing the intermediate image signals obtained from the object original image signal by correcting the reference transformation functions according to both the characteristic of the picture element density transformation processing and the characteristic of the enlargement.

93. A computer-readable recording medium as defined in Claim 91 in which said plurality of intermediate image signals are band-limited signals which are made by making from the original image signal a plurality of unsharp image signals which are different in frequency response characteristic, and making a plurality of band-limited signals representing the signals in the respective frequency bands of the original image signal on the basis of the unsharp image signals and the original image signal.

94. A computer-readable recording medium as defined in Claim 91 in which said program further includes the step of storing the object original image signal and the parameters for the object original image signal obtained by correcting the reference transformation functions according to the characteristic of contraction correlated to each other.

95. A computer-readable recording medium as defined in Claim 91 in which said program further includes the step of storing the reference original image signal from which the object original image signal is obtained, the characteristic of contraction with which the reference original image signal is

contracted to the object original image signal and the parameters of the reference transformation functions correlated to each other.

5 96. A computer-readable recording medium loaded with program for causing a computer to perform an image processing method for obtaining a processed image signal from an original image signal representing an original image, in which a plurality of intermediate image signals which are different in frequency band are made on the basis of the original image signal, a plurality of transformed image signals are obtained by carrying out a transformation processing on the respective intermediate image signals on the basis of respective transformation functions, and a processed image signal in which a predetermined frequency component is enhanced is obtained from the transformed image signals, wherein the improvement comprises that

10 the program includes the step of, when an enlarged processed image signal is to be obtained by enlarging the processed image signal at a desired magnification by carrying out an enlargement transformation on the processed image signal, 15 correcting the transformation functions for transforming the respective intermediate image signals according to the characteristic of the enlargement transformation so that the frequency response characteristic of a desired frequency component of the enlarged processed image signal becomes a 20 predetermined frequency response characteristic.

25 97. A computer-readable recording medium as defined in

Claim 96 in which said plurality of intermediate image signals are band-limited signals which are made by making from the original image signal a plurality of unsharp image signals which are different in frequency response characteristic, and making
5 a plurality of band-limited signals representing the signals in the respective frequency bands of the original image signal on the basis of the unsharp image signals and the original image signal.

98. A computer-readable recording medium as defined in
10 Claim 96 in which said program further includes the step of storing the object original image signal and the parameters for the object original image signal obtained by correcting the reference transformation functions according to the characteristic of enlargement correlated to each other.

99. A computer-readable recording medium as defined in
15 Claim 96 in which said program further includes the step of storing the reference original image signal from which the object original image signal is obtained, the characteristic of enlargement with which the reference original image signal is
20 enlarged to the object original image signal and the parameters of the reference transformation functions correlated to each other.